Bellevue 120th Avenue NE Corridor Project

PRELIMINARY DRAFT
Air Quality Technical Report

prepared for
City of Bellevue

prepared by
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August 20, 2010

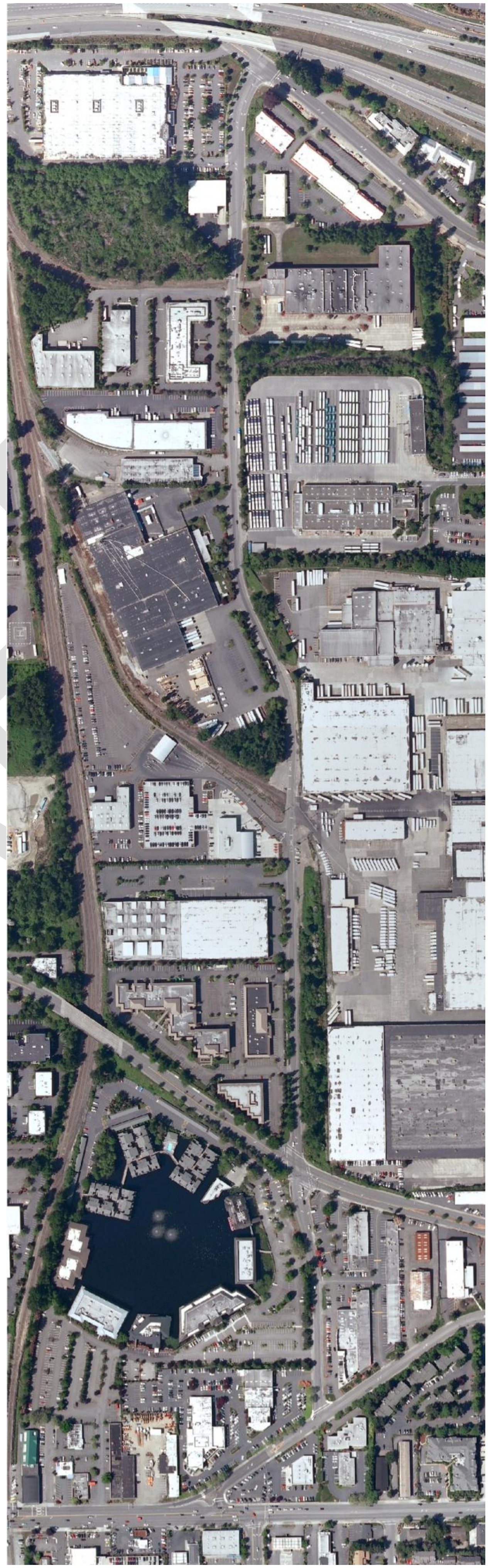


Table of Contents

Figures

Tables

Acronyms and Abbreviations

AADT	Average annual daily traffic
CAA	U.S. Clean Air Act
CAAA	Clean Air Act Amendments
CO	Carbon monoxide
DPM	Diesel particulate matter
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
HC	Hydrocarbons
IRIS	Integrated Risk Information System
LOS	Level-of-Service
MSAT	Mobile source air toxics
NAAQS	National Ambient Air Quality Standards
NATA	National Air Toxics Assessment
NEPA	National Environmental Policy Act
NH_3	Ammonia
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides
O_3	Ozone
Pb	Lead
PM	Particulate matter
PM_{10}	Particulate matter smaller than or equal to 10 microns in size
$PM_{2.5}$	Particulate matter smaller than or equal to 2.5 microns in size
ppm	Parts per million
SIP	State Implementation Plan
SO_2	Sulfur dioxide
SO_x	Sulfur oxides
TIP	Transportation Improvement Program
TSP	Total suspended particles
VHT	Vehicle hours traveled
VMT	Vehicle miles traveled
VOC	Volatile organic compounds
WAAQS	Washington Ambient Air Quality Standards
WAC	Washington Administrative Code
WASIST	Washington State Intersection Screening Tool
$\mu g/m^3$	Micrograms per cubic meter

Executive Summary

The proposed Bellevue 120th Avenue NE Corridor Project (the project) would widen an existing, mostly two-lane roadway to a five-lane arterial, with two lanes in each direction and a center turning lane. Analyses were conducted to estimate potential air quality impacts of the project. The following are the results of these analyses:

- The project is not predicted to measurably affect regional miles of travel in the study area. As such, the project is not predicted to impact regional levels of carbon monoxide (CO), particulate matter smaller than or equal to 10 microns in size (PM_{10}), particulate matter smaller than or equal to 2.5 microns in size ($PM_{2.5}$), and ozone (O_3) levels. Based on the microscale CO screening analysis, the project is not predicted to cause or exacerbate a violation of the applicable ambient air quality standards. As such, it complies with the U.S. Environmental Protection Agency's (EPA) local (microscale) requirements under its Conformity Rule for a project located in a CO maintenance area.
- As the study area is designated as being in attainment for all other air quality standards, no additional project-level conformity demonstration is required.
- The project is included in the Central Puget Sound Regional 2010-2013 Transportation Improvement Program (TIP) as Award Reference Number 09-10-KGCO-02, 120th Avenue NE Corridor – NE 4th to Northup Way (Segments 2 and 3). As such, it meets all regional (mesoscale) requirements of 40 CFR 93 and WAC 173-420.
- Mobile source air toxic levels are predicted to decrease significantly in the future as a result of federally mandated programs. The project is not expected to affect this reduction.
- Construction-related effects of the project would be limited to short-term increased fugitive dust and mobile-source emissions during construction. State and local regulations regarding dust control and other air quality emission reduction controls should be followed.

1.0 Introduction

1.1 Purpose of This Report

This *Air Quality Technical Report* (technical report) is being prepared as part of the Bellevue 120th Avenue NE Corridor Project (the project) for the City of Bellevue, which proposes to widen 120th Avenue NE from NE 8th Street in the south to Northup Way in the north. The purpose of this report is to evaluate the effects of the proposed project on air quality in the project area, including the following:

- A microscale CO analysis
- A mobile source air toxic (MSAT) analysis
- A construction analysis

1.1.1 Permits Needed

There would be no permits required with respect to air quality.

2.0 Proposed Project

2.1 Project Overview

The 120th Avenue NE Corridor Project (Segments 2 and 3) extends from just south of NE 8th Street to Northup Way. The City of Bellevue (City) proposes to widen the existing corridor from a two-lane roadway to a five-lane roadway Error! Reference source not found. shows the project study area.

Figure 2-1. Project Study Area

The elements of the project include the following:

- Widen to five travel lanes (two travel lanes in each direction and a center turn lane)
- Realign the roadway south of Bel-Red Road to improve intersection operations at the NE 8th Street intersection
- Install continuous sidewalks and bicycle lanes on both sides of the street designed to City arterial street standards
- Include planting strips on both sides of the roadway, and other green spaces where possible
- Install storm drainage and water quality facilities that use natural drainage practices
- Connect with and minimize adverse affects to open-space areas and wetlands
- Accommodate new intersections with the planned NE 15th Street/NE 16th Street Corridor and Sound Transit's East Link light rail line

Other project elements include illumination, landscaping, structural walls, traffic signals, and new and relocated utilities (Figure 2-2).

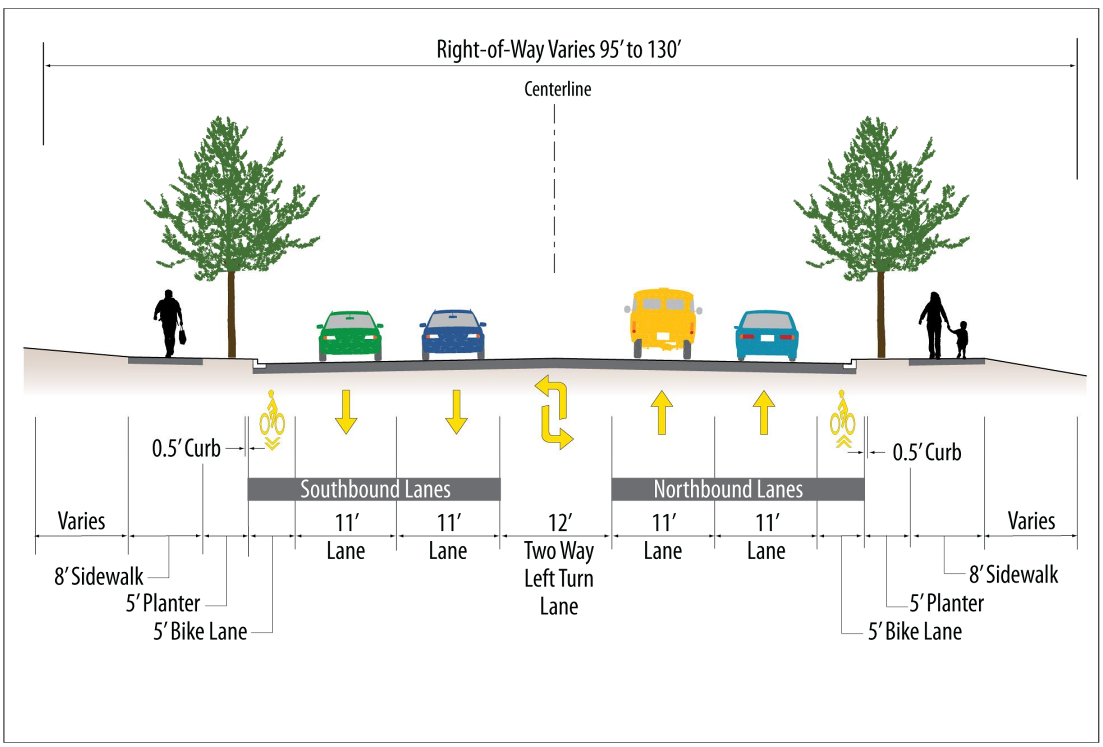


Figure 2-2: Typical Cross Section

The term “right-of-way”, as used in this report, includes both right-of-way owned by the City and permanent easement, i.e. the complete footprint of the project.

Project construction would occur over a two-year period. It is assumed that improvements from NE 8th Street to NE 12th Street would be completed and opened to traffic prior to those from NE 12th Street to Northup Way. This construction sequencing would minimize traffic impacts.

A minimum of one lane would be open for traffic in each direction along 120th Avenue NE as the project is constructed. The construction would occur on one-half of the roadway at a time. Only Bel-Red Road would be closed for any length of time (9 to 12 months) during the realignment of 120th Avenue NE near NE 8th Street.

Generally, the work is anticipated to occur in the following sequences:

- Contractor Mobilization—Months 1 and 2
- NE 8th Street to NE 12th Street Improvements—Months 3–12:
    - Traffic control and temporary erosion control
    - Utility relocation/installation
    - Roadway Side 1—Retaining walls, grading, paving, signals, and illumination
    - Roadway Side 2—Retaining walls, grading, paving, signals, and illumination
- NE 12th Street to Northup Way Improvements—Months 13-24
    - Traffic control and temporary erosion control
    - Utility relocation/installation
    - Roadway Side 1—Retaining walls, grading, paving, signals, and illumination
    - Roadway Side 2—Retaining walls, grading, paving, signals, and illumination

The *Project Description Technical Report* contains a detailed description of the project.

3.0 Methods

The following methods were applied to the effects analysis contained in this report. Reasons were provided for methods that varied from Washington Department of Transportation standards.

3.1 Air Pollutants and Standards

Air pollution is a general term that refers to one or more chemical substances that degrade the quality of the atmosphere. Individual air pollutants degrade the atmosphere by reducing visibility, damaging property, reducing the productivity or vigor of crops or natural vegetation, or harming human or animal health.

3.1.1 Clean Air Act Amendments of 1990

The Clean Air Act (CAA) Amendments of 1990 and the Final Transportation Conformity Rule [40 CFR Parts 51 and 93] direct the EPA to implement environmental policies and regulations that will ensure acceptable levels of air quality. The CAA and the Final Transportation Conformity Rule affect proposed transportation projects. According to Title I, Section 176 (c) 2:

> "No federal agency may approve, accept, or fund any transportation plan, program, or project unless such plan, program, or project has been found to conform to any applicable State Implementation Plan (SIP) in effect under this act."

The Final Conformity Rule defines conformity as follows:

> "Conformity to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards (NAAQS) and achieving expeditious attainment of such standards; and that such activities will not:
>
> - Cause or contribute to any new violation of any NAAQS in any area;
> - Increase the frequency or severity of any existing violation of any NAAQS in any area; or
> - Delay timely attainment of any NAAQS or any required interim emission reductions or other milestones in any area."

3.1.2 National and State Ambient Air Quality Standards

As required by the Clean Air Act, NAAQS have been established for six major air pollutants. These pollutants, known as criteria pollutants, are CO, nitrogen dioxide (NO_2), O_3, particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), and lead (Pb). The State of Washington has also established Washington Ambient Air Quality Standards (WAAQS) that apply throughout Washington State. These standards are either the same or more stringent than the corresponding federal standards.

Table 3-1 summarizes the state and federal standards. “Primary” standards have been established to protect public health. “Secondary” standards are intended to protect the nation’s welfare and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the general welfare. Washington State has primary standards only.

Table 3-1. State and Federal Ambient Air Quality Standards

Pollutant	Averaging Time	Washington Standards (Primary)	Federal Standards (Primary)	Federal Standards (Secondary)
Ozone (O_3)	1 hour	0.12 ppm (235 μg/m^3)	0.12 ppm (235 μg/m^3) (applies in only limited areas)	Same as primary standard
	8 hour(1)	--	0.075 ppm (147 μg/m^3)	Same as primary standard
Carbon Monoxide (CO)	8 hour(2)	9 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	None
	1 hour(2)	35 ppm (40 mg/m^3)	35 ppm (40 mg/m^3)	
Nitrogen Dioxide (NO_2)	Annual arithmetic mean	0.05 ppm (100 μg/m^3)	0.053 ppm (100 μg/m^3)	Same as primary standard
	1 hour	--	0.1 ppm	None
Sulfur Dioxide (SO_2)	Annual arithmetic mean	0.02 ppm	0.030 ppm (80 μg/m^3)	-
	24 hour(2)	0.10 ppm	0.14 ppm (365 μg/m^3)	-
	3 hour		-	0.5 ppm (1,300 μg/m^3)
	1 hour(6)	0.40 ppm		
	1 hour(7)	0.25 ppm		
Particulate Matter (PM_{10})	Annual arithmetic mean	50 μg/m^3	--	--
	24 hour(3)	150 μg/m^3	150 μg/m^3	Same as primary standard
Particulate Matter ($PM_{2.5}$)	Annual arithmetic mean(4)	--	15 μg/m^3	Same as primary standard
	24 hour(5)	--	35 μg/m^3	
Total Suspended Particulates (TSP)(6)	Annual geometric mean	60 μg/m^3		
	24 hour	150 μg/m^3	--	--
Lead (Pb)	Quarterly arithmetic mean	1.5 μg/m^3	1.5 μg/m^3	-

Source: http://www.ecy.wa.gov/programs/air/Nonattainment/WA_Stds_April2010.pdf and http://www.epa.gov/air/criteria.html

(1) To attain this standard, the three-year average of the fourth-highest daily maximum eight-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm.

(2) Not to be exceeded more than once per year.

(3) Not to be exceeded more than once per year on average over three years.

(4) To attain this standard, the three-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m3.
(5) To attain this standard, the three-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m3 (effective December 17, 2006).
(6) Not to be above this level more than once in a calendar year.
(7) Not to be above this level more than twice in a consecutive seven-day period.

3.2 Criteria Pollutants and Effects

Pollutants that have established national standards are referred to as "criteria pollutants." The sources of these pollutants, their effects on human health and the nation's welfare, and their final deposition in the atmosphere vary considerably. A brief description of each pollutant is provided below.

3.2.1 Ozone

O_3 is a colorless, toxic gas. As shown in Figure 3-1, O_3 is found in both the Earth's upper and lower atmosphere. In the upper atmosphere, O_3 is a naturally occurring gas that helps prevent the sun's harmful ultraviolet rays from reaching Earth. In the lower layer of the atmosphere, O_3 is man-made. Although O_3 is not directly emitted, it forms in the lower atmosphere through a chemical reaction between reactive organic gases and nitrogen oxides (NOx), which are emitted from industrial sources and from automobiles. Substantial O_3 formations generally require a stable atmosphere with strong sunlight; thus high levels of O_3 are generally a concern during summer. O_3 is the main ingredient of smog. It enters the blood stream through the respiratory system and interferes with the transfer of oxygen, depriving sensitive tissues in the heart and brain of oxygen. O_3 also damages vegetation by inhibiting their growth.

Source: http://www.ozoneny.org/about_ozone/good_vs_bad_ozone.asp

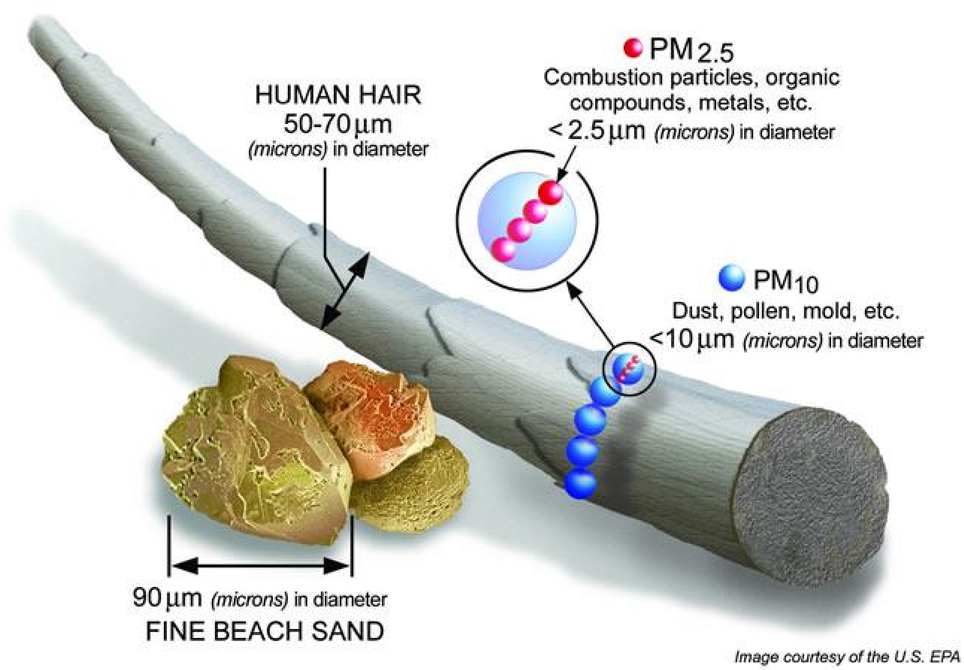
Figure 3-1. Ozone in the Atmosphere

3.2.2 Particulate Matter

Particulate pollution is composed of solid particles or liquid droplets that are small enough to remain suspended in the air. In general, particulate pollution can include dust, soot, and smoke; these can be irritating but usually are not poisonous.

Particulate pollution also can include bits of solid or liquid substances that can be highly toxic. Of particular concern are those particles that are smaller than, or equal to, 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$) in size.

PM_{10} refers to particulate matter less than 10 microns in diameter, about 1/7th the thickness of a human hair (Figure 3-2). Particulate matter pollution consists of very small liquid and solid particles floating in the air, which can include smoke, soot, dust, salts, acids, and metals. Particulate matter also forms when gases emitted from motor vehicles and industries undergo chemical reactions in the atmosphere. Major sources of PM_{10} include motor vehicles; wood-burning stoves and fireplaces; dust from construction, landfills, and agriculture; wildfires and brush/waste burning; industrial sources; windblown dust from open lands; and atmospheric chemical and photochemical reactions. Suspended particulates produce haze and reduce visibility.



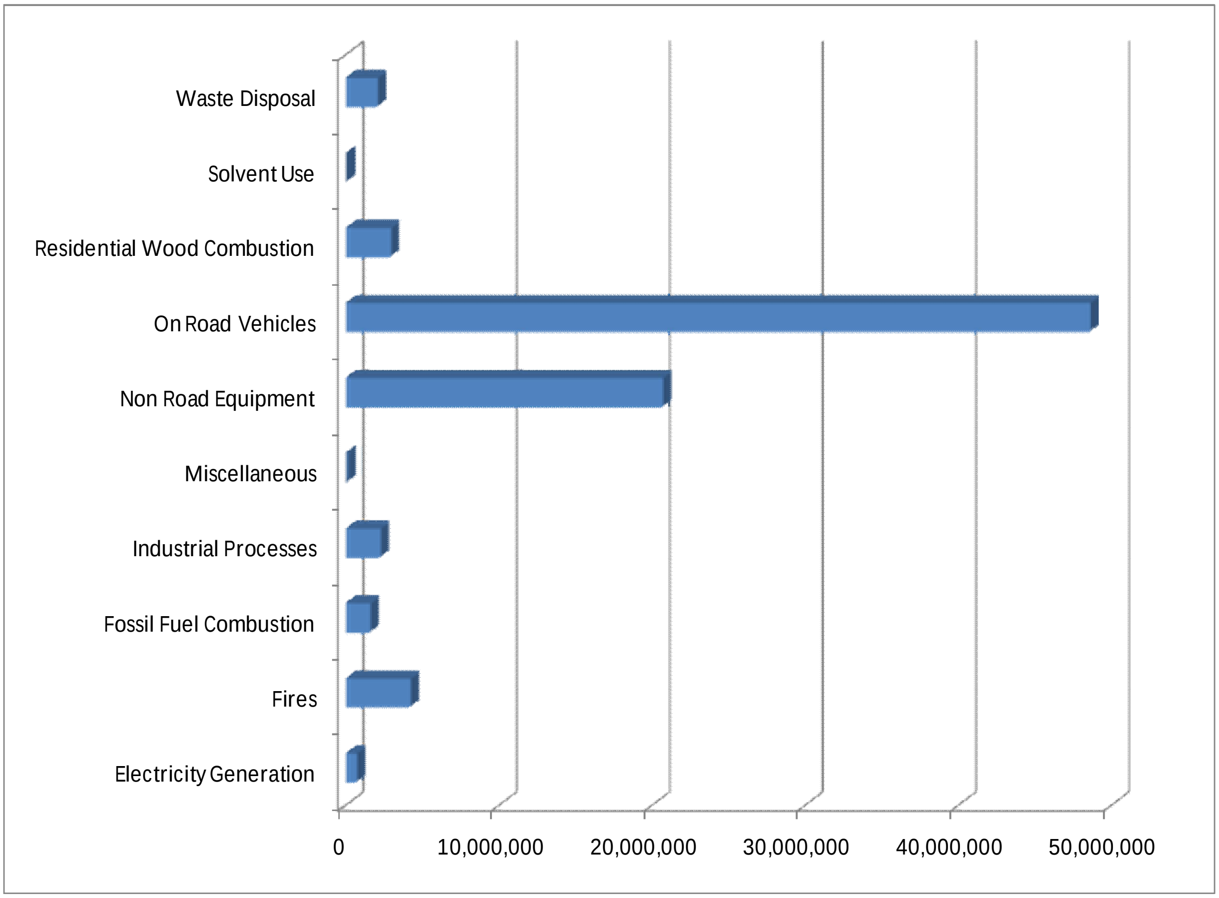
Source: http://www.epa.gov/airscience/images/pm2.5_graphic.jpg

Figure 3-2. Relative Particulate Matter Size

Data collected through numerous nationwide studies indicate most PM_{10} comes from fugitive dust, wind erosion, and/or agricultural and forestry sources. A small portion of particulate matter is the product of fuel combustion processes. In the case of $PM_{2.5}$, the combustion of fossil fuels accounts for a significant portion of this pollutant. The main health effect of airborne particulate matter is on the respiratory system. $PM_{2.5}$ refers to particulates that are 2.5 microns or less in diameter, roughly 1/28th the diameter of a human hair. $PM_{2.5}$ results from fuel combustion (from motor vehicles, power generation, and industrial facilities), residential fireplaces, and wood stoves. In addition, $PM_{2.5}$ can be formed in the atmosphere from gases such as SO_2, NOx, and volatile organic compounds (VOCs). Like PM_{10}, $PM_{2.5}$ can penetrate the human respiratory system's natural defenses and damage the respiratory tract when inhaled. Whereas, particles 2.5 to 10 microns in diameter tend to collect in the upper portion of the respiratory system, particles 2.5 microns or less are so tiny they can penetrate deeper into the lungs and damage lung tissues.

3.2.3 Carbon Monoxide

CO, a colorless gas, interferes with the transfer of oxygen to the brain. CO is emitted almost exclusively from the incomplete combustion of fossil fuels. As shown in Figure 3-3, on-road motor vehicle exhaust is the primary source of CO. In cities, 85 to 95 percent of all CO emissions may come from motor vehicle exhaust. Prolonged exposure to high levels of CO can cause headaches, drowsiness, loss of equilibrium, or heart disease. CO levels are generally highest in colder months when inversion conditions (warmer air traps colder air near the ground) are more frequent. CO concentrations can vary greatly over relatively short distances. Relatively high concentrations of CO are typically found near congested intersections, along heavily used roadways carrying slow-moving traffic, and in areas where atmospheric dispersion is inhibited by urban "street canyon" conditions. Consequently, CO concentrations must be predicted on a localized, or microscale, basis.



Source: http://www.epa.gov/air/emissions/co.htm

Figure 3-3. Sources of CO in 2005 (Tons)

3.2.4 Nitrogen Dioxide

NO_2, a brownish gas, irritates the lungs. It can cause breathing difficulties at high concentrations. As with O_3, NO_2 is not directly emitted but is formed through a reaction between nitric oxide (NO) and atmospheric oxygen. NO and NO_2 are collectively referred to as NOx and are major contributors to ozone formation. NO_2 also contributes to the formation of PM_{10}. At atmospheric concentrations, NO_2 is only potentially irritating. In high concentrations, the result is a brownish-red cast to the atmosphere and reduced visibility. There is some indication of a relationship between NO_2 and chronic pulmonary fibrosis. Some increase in bronchitis in children (two and three years old) has also been observed at concentrations below 0.3 parts per million (ppm).

3.2.5 Lead

Pb is a stable element that persists and accumulates both in the environment and in animals. Its principal effects in humans are on the blood-forming, nervous, and renal systems. Lead levels in the urban environment from mobile sources have significantly decreased due to the federally mandated switch to lead-free gasoline.

3.2.6 Sulfur Dioxide

SO_2 is a product of high-sulfur fuel combustion. The main sources of SO_2 are coal and oil used in power stations, industry, and for domestic heating. Industrial chemical manufacturing is another source of SO_2, which is an irritant gas that attacks the throat and lungs. It can cause acute respiratory symptoms and diminished ventilator function in children. SO_2 can also yellow plant leaves and erode iron and steel.

3.3 Mobile Source Air Toxics (MSATs)

In addition to the criteria pollutants for which there are NAAQS, EPA also regulates air toxics. Toxic air pollutants are those pollutants known or suspected to cause cancer or other serious health effects. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories or refineries).

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments (CAAA) of 1990, whereby Congress mandated that EPA regulate 188 air toxics, also known as hazardous air pollutants. EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (*Federal Register*, Vol. 72, No. 37, page 8430, February 26, 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (http://www.epa.gov/ncea/iris/index.html). In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from its 1999 National Air Toxics Assessment (NATA) (http://www.epa.gov/ttn/atw/nata1999/). These are acrolein, benzene, 1,3-butadiene, diesel particulate matter (DPM) plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. While the Federal Highway Administration (FHWA) considers these the priority MSATs, the list is subject to change and may be adjusted in consideration of future EPA rules.

The 2007 EPA rule requires controls that will dramatically decrease MSAT emissions through cleaner fuels and cleaner engines. According to an FHWA analysis using EPA's MOBILE6.2 model, even if vehicle activity (vehicle miles traveled, or VMT) increases by 145 percent as assumed, a combined reduction of 72 percent in the total annual emission rate for the priority MSAT is projected from 1999 to 2050.

4.0 Existing Conditions

4.1 Attainment Status/Regional Air Quality Conformity

Section 107 of the 1977 CAAA requires that EPA publish a list of all geographic areas in compliance with the NAAQS, as well as those areas not in attainment with the NAAQS. Areas not in compliance with the NAAQS are termed nonattainment areas. Areas that have insufficient data to make a determination are unclassified and are treated as being in attainment areas until proven otherwise. The designation of an area is made on a pollutant-by-pollutant basis. Table 4-1 shows the EPA's area designations.

Table 4-1. Attainment Classifications and Definitions

Attainment	Unclassified	Maintenance	Nonattainment
Area is in compliance with the NAAQS.	Area has insufficient data to make a determination and is treated as being in attainment.	Area once classified as nonattainment but has since demonstrated attainment of the NAAQS.	Area is not in compliance with the NAAQS.

The project study area is classified as a maintenance area for CO and an attainment area for all other criteria pollutants (Figure 4-1).

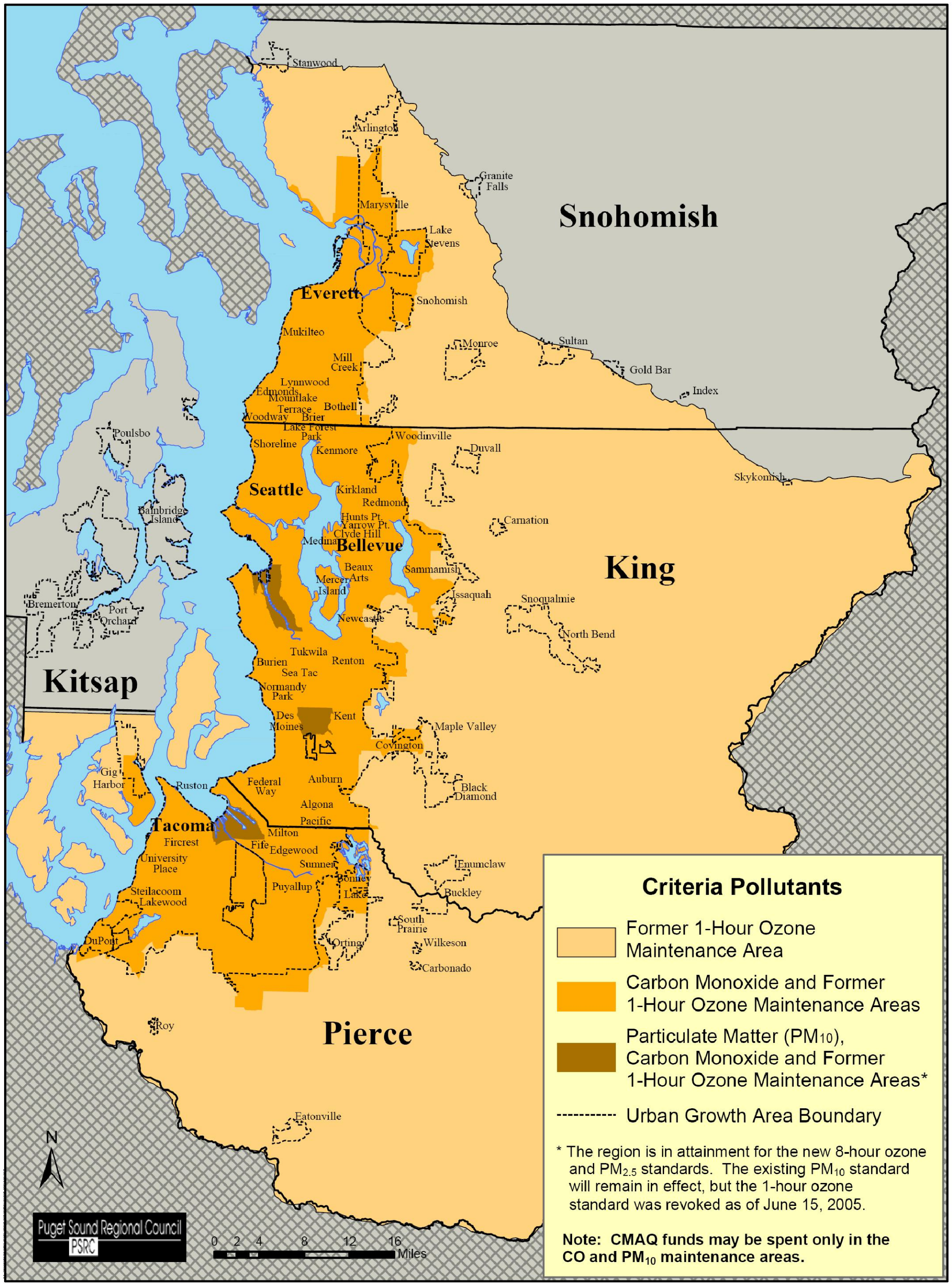


Figure 4-1. Puget Sound Maintenance Areas

4.2 Monitored Air Quality

Table 4-2 presents ambient air quality monitoring data for CO, $PM_{2.5}$, PM_{10}, NO_x, and SO_2 for the years 2006-2008 (the most recent years with available data). Monitoring data were not available for Pb in King County.

Table 4-2. Ambient Air Quality Monitored Data 2006 – 2008

Pollutant		2421 148th NE Bellevue			4103 Beacon Hill S Seattle			17171 Bothel Way Lake Forest		
		2006	2007	2008	2006	2007	2008	2006	2007	2008
Carbon Monoxide (CO) [ppm]										
1-Hour	Maximum	5.1	3.9	3.4	2.3	1.4	1.4			
	2nd Maximum	4.4	3.5	3.1	2	1.4	1.2			
	Number of Exceedances	0	0	0	0	0	0			
8-Hour	Maximum	3.7	2.7	2.3	1.5	1	0.9			
	2nd Maximum	3.4	2.6	1.9	1.2	1	0.9			
	Number of Exceedances	0	0	0	0	0	0			
Particulate Matter(PM) [ug/m^3]										
PM_{10}	Maximum 24-Hour				42					
	Mean Annual				26					
	Number of Exceedances				0					
$PM_{2.5}$	Maximum 24-Hour	19*	17*	15*	26	29	21	68	35	33
	Mean Annual	7.0*	6.3*	5.8*	7.9	7.2	7.3	9.4	8.5	10.1
	Number of Exceedances	0	0	0	0	0	0	0	0	0
Ozone (O_3) [ppm]										
8-Hour	First Highest					0.098	0.065			
	Second Highest					0.072	0.058			
	Third Highest					0.06	0.055			
	Fourth Highest					0.058	0.053			
	Number of Days Standard Exceeded					0	0			
Nitrogen Dioxide (NO_2) [ppm]										
1-Hour Maximum					0.053					
1-Hour Second Maximum					0.051					
Annual Mean					0.018					
Number of Days Standard Exceeded					0					
Sulfur Dioxide (SO_2) [ppm]										
1-Hour Maximum						0.039	0.073			
3-Hour Maximum						0.028	0.03			
24-Hour Maximum						0.007	0.11			
Annual Mean						0.002	0.001			

Sources: EPA Air Data: http://www.epa.gov/air/data/geosel.html and Puget Sound Clean Air Agency's 2008 Air Quality Data Summary.

Note: * Three-year average values.

5.0 Environmental Effects

5.1 Direct Effects on Air Quality

Direct effects are caused by the action and occur at the same time and place as the project.

5.1.1 Effects During Construction

In general, construction-related effects of the project would be limited to short-term increased fugitive dust and mobile-source emissions during construction. State and local regulations regarding dust control and other air quality emission-reduction controls should be followed.

Temporary fugitive PM_{10} emissions from the project are associated with construction activities, such as demolition, land clearing, ground excavation, grading, cut-and-fill operations, and structure erection. PM_{10} emissions would vary daily depending on the level of activity, specific operations, and weather conditions. Emission rates would depend on soil moisture, silt content of soil, wind speed, and the amount and type of operating equipment associated with project construction. Larger dust particles would settle near the source, and fine particles would be dispersed over greater distances from the construction site.

Temporary fugitive PM_{10} emissions from construction activities could be noticeable if uncontrolled. Mud and particulates from trucks would be noticeable if construction trucks are routed through residential neighborhoods. Measures to reduce the deposition of mud and emissions of particulates are listed in Section 5.6, Mitigation Measures.

In addition to PM_{10} emissions, heavy trucks and construction equipment powered by gasoline and diesel engines would generate $PM_{2.5}$, CO, and NO_x in exhaust emissions. If construction traffic and lane closures were to increase congestion and reduce the speed of other vehicles in the area, emissions from traffic would increase temporarily while those vehicles are delayed. These emissions would be temporary and limited to the immediate area where the congestion is occurring. Some construction phases (particularly during paving operations using asphalt) would result in short-term odors. These odors might be detectable to some people near the site and would be diluted as distance from the site increases.

5.1.2 Effects During Operation

Criteria Pollutants

Pollutants that can be traced principally to motor vehicles are relevant to the evaluation of the project's effects; these pollutants include CO, hydrocarbons (HC), NO_x, O_3, PM_{10}, $PM_{2.5}$, and MSATs. Transportation sources account for a small percentage of regional emissions of SO_x and Pb; thus, a detailed analysis is not required.

HC (VOC) and NO_x emissions from automotive sources are a concern primarily because they are precursors in the formation of ozone and particulate matter. Ozone is formed through a series of reactions that occur in the atmosphere in the presence of sunlight. Since the reactions are slow and occur as the pollutants are diffusing downwind, elevated ozone levels often are found many miles from the sources of the precursor pollutants. Therefore, the effects of HC and NO_x emissions generally are examined on a regional or “mesoscale” basis.

PM_{10} and $PM_{2.5}$ effects are both regional and local. A significant portion of particulate matter, especially PM_{10}, comes from disturbed vacant land, construction activity, and paved road dust. $PM_{2.5}$ also comes from these sources. Motor vehicle exhaust, particularly from diesel vehicles, is also a source of PM_{10} and $PM_{2.5}$. PM_{10}, and especially $PM_{2.5}$, can also be created by secondary formation from precursor elements such as SO_2, NO_X, VOCs, and ammonia (NH_3). Secondary formation occurs due to chemical reaction in the atmosphere generally downwind some distance from the original emission source. Thus, it is appropriate to predict concentrations of PM_{10} and $PM_{2.5}$ in nonattainment or maintenance areas on both a regional and localized basis in accordance with EPA’s *Transportation Conformity Guidance for Qualitative Hot-Spot Analyses in* *$PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas* (dated March 29, 2006).

CO effects are generally localized. Even under the worst meteorological conditions and most congested traffic conditions, high concentrations are limited to a relatively short distance (300 to 600 feet) of heavily traveled roadways. Vehicle emissions are the major sources of CO.

Regional Analysis

A regional or mesoscale analysis of a project determines its overall impact on regional air quality levels. In general, this analysis would use regional VMT and vehicle hours traveled (VHT) within the region with and without the project to determine daily “pollutant burden” levels. However, as the project is not predicted to affect regional VMT and VHT, it is predicted to have no measurable impact on regional pollutant levels. In addition, the project is included in the Central Puget Sound Regional 2010-2013 TIP as Award Reference Number 09-10-KGCO-02, 120th Avenue NE Corridor – NE 4th to Northup Way (Segments 2 and 3). As such, it meets all regional (mesoscale) requirements of 40 CFR 93 and WAC 173-420.

PM_{10}/$PM_{2.5}$ Analysis

The project is located in a PM_{10} and $PM_{2.5}$ attainment area. As such, a detailed analysis of PM_{10} and $PM_{2.5}$ is not required. Since the Project is not predicted to affect regional VMT or generate additional truck traffic, it is not expected to affect regional levels of PM_{10} and $PM_{2.5}$.

CO Analysis

A microscale analysis was conducted to estimate CO levels near intersections that are expected to be affected by the project. The Washington State Intersection Screening Tool (WASIST), which was used in this analysis, is a Microsoft

Windows-based screening model used for determining worst-case 1-hour and 8-hour CO concentrations at signalized intersections throughout the state. Results are based on EPA's emission factor algorithm (MOBILE6.2.03) and EPA's CAL3QHC mobile source dispersion model. The CAL3QHC algorithm was used to calculate CO concentrations in WASIST based on intersection geometry, user inputs, and worst-case assumptions. CO emission factors were determined for each approaching leg of traffic and for idling vehicles.

WASIST uses readily available data in a user-friendly application to make a conservative estimate of CO levels near congested intersections. This is done by using a combination of worst-case conditions that, when occurring simultaneously, produce the highest levels of CO. The purpose of the model is to allow the user to conservatively estimate the highest CO concentrations that would occur at an intersection without having to perform a more time-consuming detailed analysis.

The potential of the project to create localized CO concentrations that would exceed the NAAQS at the locations most affected by the project were estimated. Table 5-1 provides the level-of-service (LOS) at these intersections under existing, future no build, and future build conditions. If the results from WASIST do not violate the NAAQS for CO, the effect from any other combination of conditions would also be below the standards, and no further modeling is required.

This traffic analysis considers induced traffic growth associated with the project. Afternoon peak-period traffic data were used to estimate maximum 1-hour CO concentrations. This peak period is from the highest traffic-volume period. A persistence factor of 0.7 was applied to the 1-hour CO concentrations to obtain 8-hour CO concentrations. A persistence factor accounts for the fact that over 8 hours, vehicle volumes will fluctuate downward from the peak period and meteorological conditions will vary compared to the conservative assumptions used for the 1-hour concentration.

Table 5-1. LOS of the Intersections Evaluated

Intersection	Existing	No Build		Build	
	2010	2015	2030	2015	2030
NE 4th Street and 120th Avenue NE	N/A	B	C	D	D
NE 6th Street and 120th Avenue NE	N/A	N/A	C	N/A	F
NE 8th Street and 120th Avenue NE	D	D	E	D	E
NE 12th Street and 120th Avenue NE	C	E	E	E	E
NE 15th Street and 120th Avenue NE	N/A	N/A	F	N/A	E
NE 8th Street and Bel-Red Road	A	B	B	N/A	N/A
Bel-Red Road and 120th Avenue NE	B	C	F	N/A	N/A
Northup Way and 120th Avenue NE	B	B	C	B	C

N/A = traffic data not available.

Table 5-2 and Table 5-3 show the results of the screening-level mobile source analysis for predicted 1-hour and 8-hour PM-peak concentrations for existing, future no build, and future build conditions. The values provided are the highest 1-hour and 8-hour CO concentrations predicted at any of the receptor sites near the selected intersections for year of opening (2015), design year (2030) conditions and conformity year (2040). The estimated CO concentrations are all below the 1-hour and 8-hour NAAQS of 35 and 9 ppm, respectively. Because the predicted results were all below the NAAQS, the results of this analysis indicate that a more in-depth mobile source air quality analysis is not required, and that the CO impacts of the project are not significant.

Table 5-2. Maximum Predicted 1-Hour PM-Peak CO Concentrations (ppm)

Intersection	Existing	No Build			Build		
	2010	2015	2030	2040	2015	2030	2040
NE 4th Street at 120th Avenue NE	N/A	7.2	6.5	5.4	7.6	6.9	5.4
NE 6th Street at 120th Avenue NE	N/A	N/A	5.3	4.5	N/A	6.0	4.9
NE 8th Street at 120th Avenue NE	7.6	6.9	6.8	5.6	7.3	7.5	6.0
NE 12th Street at 120th Avenue NE	N/A	N/A	5.7	5.0	8.1	6.1	5.0
NE 15th Street at 120th Avenue NE	N/A	N/A	6.3	5.3	N/A	6.4	5.4
NE 8th Street at Bel-Red Road	8.3	7.1	6.7	5.7	N/A	N/A	N/A
Bel-Red Road at 120th Avenue NE	7.1	6.6	N/A	N/A	7.7	N/A	N/A
Northup Way at 120th Avenue NE	5.6	5.2	5.3	4.6	5.4	5.5	4.7

N/A = traffic data not available.
A background concentration of 3 ppm was used.

Table 5-3. Maximum Predicted 8-Hour PM-Peak CO Concentrations (ppm)

Intersection	Existing	No Build			Build		
	2010	2015	2030	2040	2015	2030	2040
NE 4th Street at 120th Avenue NE	N/A	5.9	5.4	4.7	6.2	5.7	4.7
NE 6th Street at 120th Avenue NE	N/A	N/A	4.5	4.0	N/A	5.1	4.3
NE 8th Street at 120th Avenue NE	6.2	5.7	5.7	4.8	6.0	6.2	5.1
NE 12th Street at 120th Avenue NE	N/A	N/A	4.9	4.4	6.6	5.2	4.4
NE 15th Street at 120th Avenue NE	N/A	N/A	5.3	4.6	N/A	5.4	4.7
NE 8th Street at Bel-Red Road	6.7	5.9	5.6	4.9	N/A	N/A	N/A
Bel-Red Road at 120th Avenue NE	5.9	5.5	N/A	N/A	6.3	N/A	N/A
Northup Way at 120th Avenue NE	4.8	4.5	4.6	3.9	4.7	4.8	4.2

N/A = traffic data not available.
A background concentration of 3 ppm and a persistence factor of 0.7 were used.

MSATs

On February 3, 2006, FHWA released its *Interim Guidance on Air Toxic Analysis in NEPA Documents.* This guidance was superseded on September 30, 2009, by

FHWA's *Interim Guidance Update on Air Toxic Analysis in NEPA Documents*. The purpose of FHWA's guidance is to advise on when and how to analyze MSATs in the NEPA process for highways. Since MSAT science is evolving, this guidance is interim. As the science progresses, FHWA will update the guidance.

Technical shortcomings of emissions and dispersion models and uncertain science with respect to health effects prevent meaningful or reliable estimates of MSAT emissions of the project. However, even though reliable methods do not exist to accurately estimate the health effects of MSATs at the project level, it is possible to qualitatively assess the levels of future MSAT emissions. The qualitative assessment presented below has been prepared in accordance with FHWA's Interim Guidance derived in part from a study conducted by the FHWA, *A Methodology for Evaluating Mobile Source Air Toxic Emissions among Transportation Project Alternatives*.

FHWA's Interim Guidance groups projects into the following categories:

- Exempt Projects and Projects with no Meaningful Potential MSAT Effects
- Projects with Low Potential MSAT Effects
- Projects with Higher Potential MSAT Effects

FHWA's Interim Guidance provides examples of "Projects with Low Potential MSAT Effects." These projects include minor widening projects and new interchanges, such as those that replace a signalized intersegment on a surface street or where design year traffic projections are less than 140,000 to 150,000 average annual daily traffic (AADT).

The Build Alternative would widen 120th Avenue NE from NE 8th Street to Northup Way. The highest projected design year AADT is 22,500. This is within FHWA's criteria for a project with "Low Potential MSAT Effects." Therefore, the project meets the criteria for a "Project with Low Potential MSAT Effects" and has been evaluated as such.

Based on the recommended tiering approach detailed in the FHWA methodology, the project falls within the Tier 2 category. For the Build Alternative, the amount of MSAT emitted would be proportional to the VMT, assuming that other variables such as fleet mix are the same for each alternative. There is not expected to be any regional change in VMT with the Build Alternative when compared to the No Build Alternative. Local VMT along 120th Avenue NE would increase, however, because the additional capacity increases the efficiency of the roadway and attracts rerouted trips from elsewhere in the transportation network. This increase in VMT would lead to higher MSAT emissions for the Build Alternative along the highway corridor, along with a corresponding decrease in MSAT emissions along parallel routes. This emissions increase is offset somewhat by lower MSAT emission rates due to increased speeds; according to EPA's MOBILE6.2 model, emissions of all of the priority MSAT except for DPM decrease as speed increases. The extent to which these speed-related emission decreases will offset VMT-related emission increases cannot be reliably projected because of the inherent deficiencies of technical models. Emissions will likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce annual MSAT emissions by 72 percent between 1999 and 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

The additional travel lanes contemplated as part of the Build Alternative would have the effect of moving some traffic closer to nearby land uses on 120th Avenue NE. Therefore, under the Build Alternative there may be localized areas where ambient concentrations of MSAT could be higher than under the No Build Alternative.

The magnitude and the duration of these potential increases compared to the No Build Alternative cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific MSAT health effects. In sum, when a highway is widened, the localized level of MSAT emissions for the Build Alternative could be higher relative to the No Build Alternative, but this could be offset as a result of increases in speeds and reductions in congestion (which are associated with lower MSAT emissions). In addition, MSAT will be lower in other locations when traffic shifts away from them. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT levels to be significantly lower than today.

This technical report includes a basic analysis of the likely MSAT emission effects of the project. However, available technical tools do not enable prediction of project-specific health effects of the emission changes associated with the project alternatives. As a result of these limitations, the following discussion is included in accordance with the Council on Environmental Quality's regulations (40 CFR 1502.22(b)) regarding incomplete or unavailable information.

Information that is Unavailable or Incomplete

Evaluating the environmental and health effects from MSATs on a proposed highway project would involve several key elements, including emissions modeling, dispersion modeling to estimate ambient concentrations resulting from the estimated emissions, exposure modeling to estimate human exposure to the estimated concentrations, and then a final determination of health effects based on the estimated exposure. Each of these steps is encumbered by technical shortcomings or uncertain science that prevents a more complete determination of the MSAT health effects of this project.

Emissions

The EPA tools to estimate MSAT emissions from motor vehicles are not sensitive to key variables determining emissions of MSATs in the context of highway projects.

Dispersion

The tools to predict how MSATs disperse are also limited. EPA's current regulatory models, CALINE3 and CAL3QHC, were developed and validated more than a decade ago for the purpose of predicting episodic concentrations of CO to determine compliance with the NAAQS. The performance of dispersion models is more accurate for predicting maximum concentrations that can occur at some time at some location within a geographic area. This limitation makes it difficult to predict accurate exposure patterns at specific times at specific highway project locations across an urban area to assess potential health risk.

Exposure Levels and Health Effects

Finally, even if emission levels and concentrations of MSATs could be accurately predicted, shortcomings in current techniques for exposure assessment and risk analysis preclude drawing meaningful conclusions about project-specific health effects. Exposure assessments are difficult because it is difficult to accurately calculate annual concentrations of MSATs near roadways and to determine the portion of a year that people are actually exposed to those concentrations at a specific location. These difficulties are magnified for 70-year cancer assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over a 70-year period.

Summary of Existing Credible Scientific Evidence Relevant to Evaluating the Effects of MSATs

Research into the health effects of MSATs is ongoing. For different emission types, a variety of studies show that either some are statistically associated with adverse health outcomes through epidemiological studies (frequently based on emissions levels found in occupational settings) or that animals demonstrate adverse health outcomes when exposed to large doses.

Exposure to toxics has been a focus of a number of EPA efforts. Most notably, the agency conducted the NATA in 1996 to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of, or benchmark for, local exposure, the modeled estimates in the NATA database best illustrate the levels of various toxics when aggregated to a national or state level.

EPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The EPA IRIS is a database of human health effects that may result from exposure to various substances found in the environment. The IRIS database is located at http://www.epa.gov/iris.

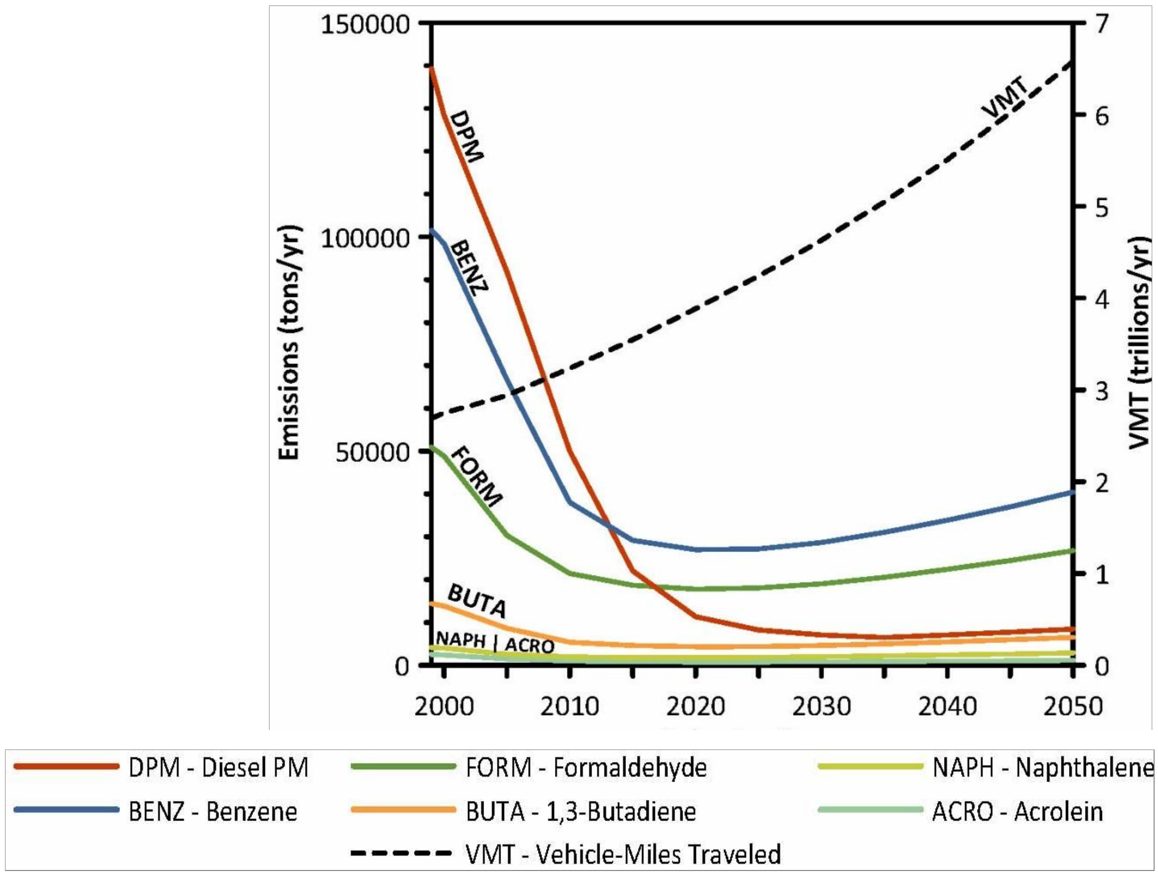
There have been other studies that address MSAT health effects in proximity to roadways. The Health Effects Institute, a non-profit organization funded by the EPA, FHWA, and industry, has undertaken a major series of studies to research near-roadway MSAT hot spots, the health implications of the entire mix of mobile source pollutants, and other topics. The final summary of the series is not expected for several years.

Some recent studies have reported that proximity to roadways is related to adverse health outcomes—particularly respiratory problems. Much of this research is not specific to MSATs, instead surveying the full spectrum of both criteria and other pollutants. The FHWA cannot evaluate the validity of these studies, but more importantly, the studies do not provide information that would be useful to alleviate the uncertainties listed above and enable us to perform a more comprehensive evaluation of the health effects specific to this project.

Relevance of Unavailable or Incomplete Information

Because of the uncertainties outlined above, a quantitative assessment of the effects of air toxic emissions on human health cannot be made at the project level. While available tools do allow a reasonable estimate of relative emission changes among alternatives for larger projects, the amount of MSAT emissions from each of the project alternatives and MSAT concentrations or exposures created by each of the project alternatives cannot be predicted with enough accuracy to be useful in estimating health effects. (As noted above, the current emissions model is not capable of serving as a meaningful emissions analysis tool for smaller projects.) Therefore, the relevance of the unavailable or incomplete information is that it is not possible to make a determination of whether any of the alternatives would have "significant adverse effects on the human environment."

Emissions would likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to dramatically decrease MSAT emissions through cleaner fuels and cleaner engines. According to an FHWA analysis using EPA's MOBILE6.2 model, even if vehicle activity (VMT) increases by 145 percent as assumed, a combined reduction of 72 percent in the total annual emission rate for the priority MSAT is projected from 1999 to 2050, as shown in Figure 5-1.



(1) Annual emissions of polycyclic organic matter are projected to be 561 tons/yr for 1999, decreasing to 373 tons/yr for 2050.
(2) Trends for specific locations may be different, depending on locally derived information representing vehicle miles traveled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors.
Source: U.S. Environmental Protection Agency. MOBILE6.2 Model run 20 August 2009.

Figure 5-1. National MSAT Emission Trends 1999–2050 for Vehicles Operating on Roadways Using EPA's Mobile6.2 Model

This document has provided a qualitative analysis of MSAT emissions relative to the various alternatives and has acknowledged that the Build Alternative may increase exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain. Because of this uncertainty, the health effects from these emissions cannot be estimated.

5.2 Indirect Effects on Air Quality

Indirect effects are associated with a project and occur later in time or farther removed in distance; but they are still reasonably foreseeable (e.g., induced land development from highway projects).

The air quality analysis described in this technical report was performed using projected traffic volumes for future years. Therefore, the air quality analysis includes the indirect effects of the project and other traffic growth that would be associated with the project.

The air quality analysis evaluated projected traffic volumes and delays that incorporate anticipated traffic generation from planned development in the project area. Therefore, the air quality analysis includes the indirect effects of the project and other traffic growth that would be associated with the project.

5.3 Cumulative Effects on Air Quality

Cumulative effects result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable actions, regardless of the agency or person initiating the other actions.

Planned development in the area has already been included in the traffic and air quality modeling for 2030. Therefore, no cumulative effects are anticipated.

5.4 Mitigation Measures

5.4.1 Mitigation of Construction Effects

Construction areas, staging areas, and material transfer sites would be set up in a way that reduces standing wait times for equipment, engine idling, and the need to block the movement of other activities on the site. These strategies would reduce fuel consumption by reducing wait times and ensuring that construction equipment operates efficiently.

In addition to the strategies detailed above, other possible air pollutant emission control measures include the following, in compliance with the Associated General Contractors of Washington 1997:

- Spraying exposed soil with water or other dust palliatives to reduce emissions of PM_{10} and deposition of particulate matter
- Covering all trucks transporting materials, wetting materials in trucks, or providing adequate freeboard (space from the top of the material to the top of the truck) to reduce particulate emissions during transportation
- Providing wheel washers to remove particulate matter that vehicles would otherwise carry offsite to decrease deposition of particulate matter on area roadways
- Removing particulate matter deposited on paved public roads to reduce mud and resultant windblown dust on area roadways
- Maintaining as many traffic lanes as possible during peak travel times to reduce air quality effects caused by increased congestion
- Placing quarry spall aprons where trucks enter public roads to reduce the amount of mud tracked out.
- Requiring appropriate emission-control devices (e.g., diesel oxygen catalyst, diesel particulate filters, and particulate traps) on large pieces of

diesel-fueled equipment to reduce CO, NO_x, and particulate emissions in vehicular exhaust

- Using relatively new, well-maintained equipment to reduce CO and NO_x emissions
- Planting vegetative cover on graded areas that would be left vacant for more than one season to reduce windblown particulates in the area
- Routing construction trucks away from residential and business areas to minimize annoyance from dust
- Requiring the use of low or ultra-low sulfur fuels in construction equipment to allow for the use of effective particulate-emission control devices on diesel vehicles
- Coordinating construction activities with other projects in the area to reduce the cumulative effects of concurrent construction projects

5.4.2 Mitigation Measures for Long-Term Effects

MSAT emissions are not expected to increase, and no exceedances of the NAAQS are anticipated. In addition, no significant adverse air quality effects are expected from the project. As a result, no mitigation measures would be required.

5.5 Conclusions

The project is predicted to comply with all applicable air quality standards and regulations. This result is based on the following:

- The project is not predicted to measurably affect regional miles of travel in the study area. As such, the project is not predicted to impact regional CO, PM_{10}, $PM_{2.5}$, and O_3 levels.
- Based on the microscale CO screening analysis conducted, the project is not predicted to cause or exacerbate a violation of the applicable ambient air quality standards. As such, the project complies with EPA's local (microscale) requirements under EPA's Conformity Rule for a project located in a CO maintenance area.
- As the study area is designated as being in attainment for all other air quality standards, no additional project-level conformity demonstration is required.
- The project is included in the Central Puget Sound Regional 2010-2013 TIP as Award Reference Number 09-10-KGCO-02, 120th Avenue NE Corridor – NE 4th to Northup Way (Segments 2 and 3). As such, it meets all regional (mesoscale) requirements of 40 CFR 93 and WAC 173-420.
- MSAT levels are predicted to decrease significantly in the future due to federally mandated programs. The project is not expected to affect this reduction.

- Construction-related effects of the project would be limited to short-term increased fugitive dust and mobile-source emissions during construction, and state and local regulations regarding dust control and other air quality emission reduction controls should be followed.

6.0 References

EPA 2006	U.S. Environmental Protection Agency (EPA). March 2006. *Transportation Conformity Guidance for Qualitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*. EPA420-B-06-902.
EPA 2007	U.S. Environmental Protection Agency (EPA). February 26, 2007. *Control of Hazardous Air Pollutants from Mobile Sources.*
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